

Energy Efficiency

Evan Mills, Ph.D.

Staff Scientist

U.S. Department of Energy

Lawrence Berkeley National Laboratory

University of California

<http://evanmills.lbl.gov> • emills@lbl.gov

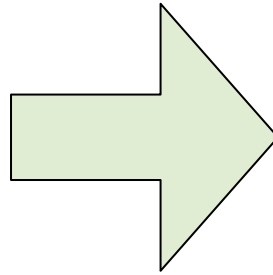
**Everything can always be
done better than it is.**

- Henry Ford

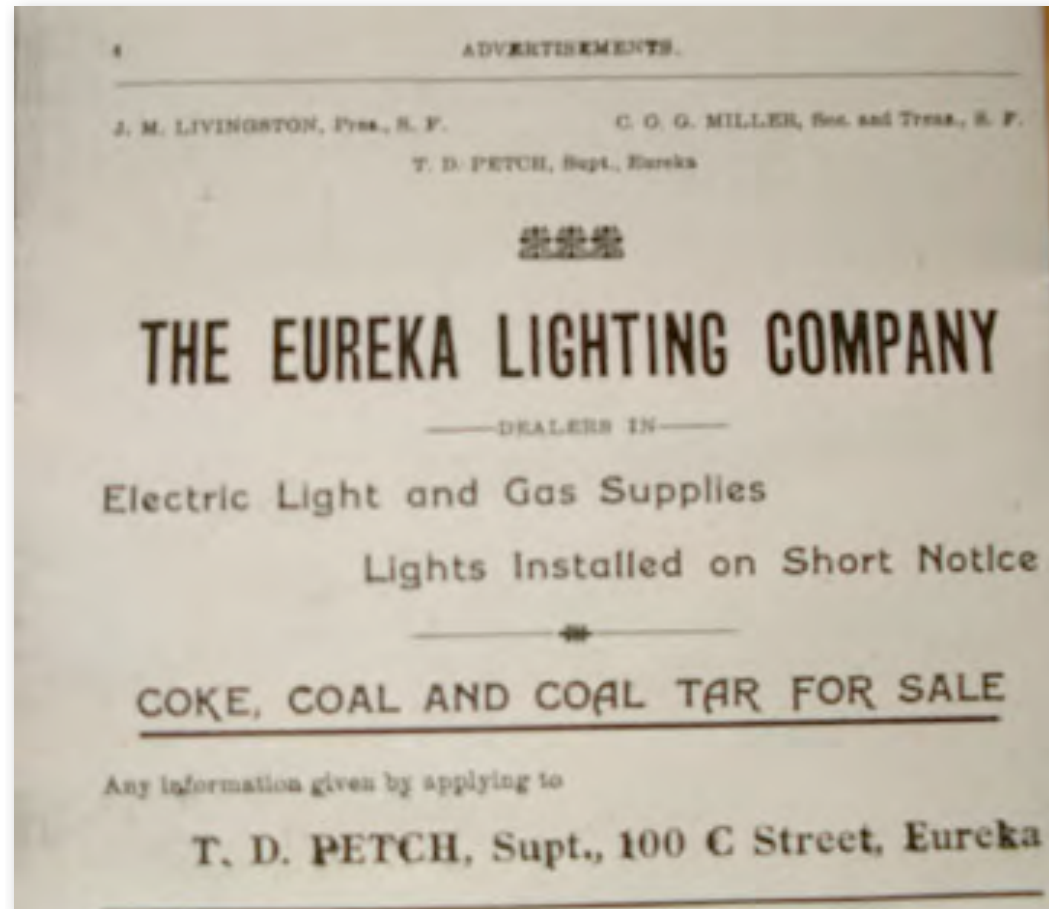


~10% efficiency (90% waste)

The Kakelung: Product of an Early (1776) Energy Crisis in Sweden

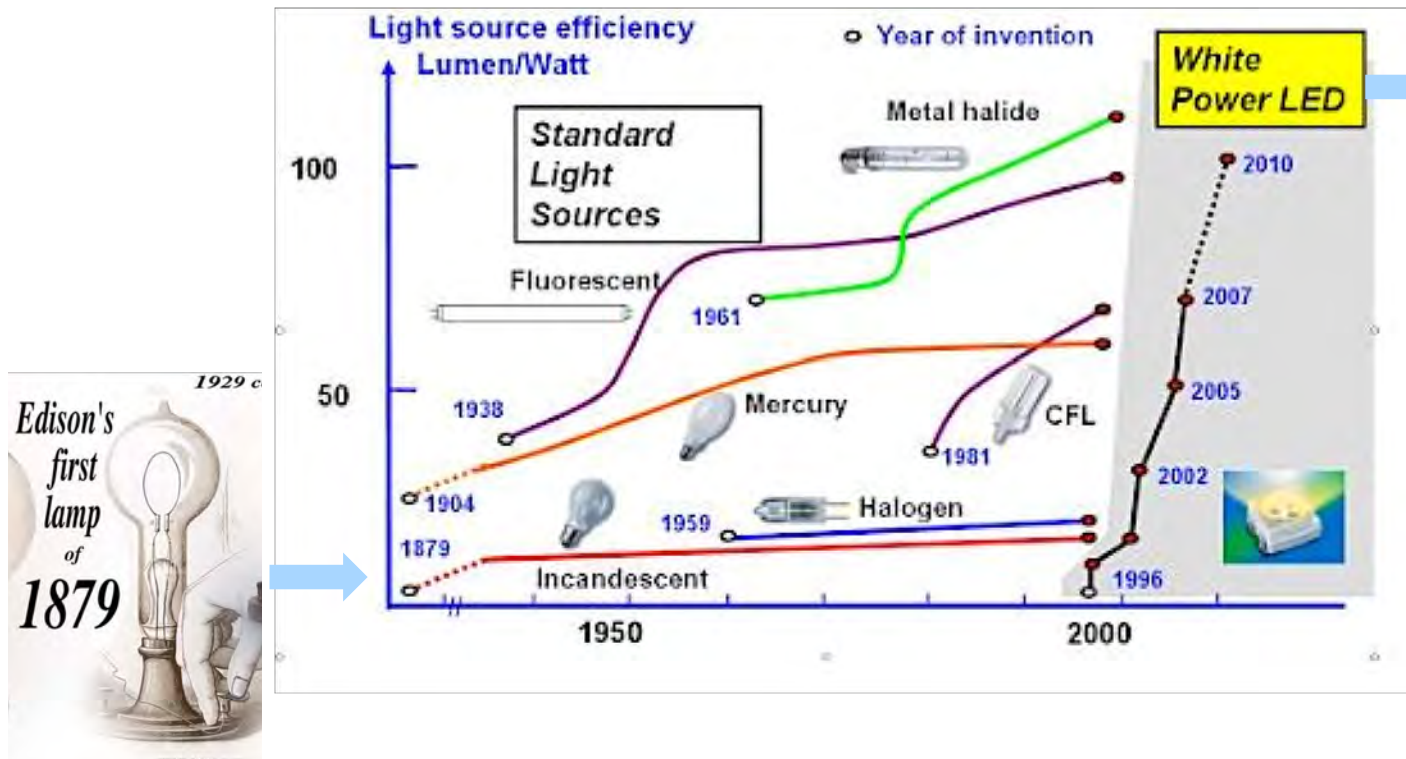


Efficiency is Competitive



“Energy Service Companies”

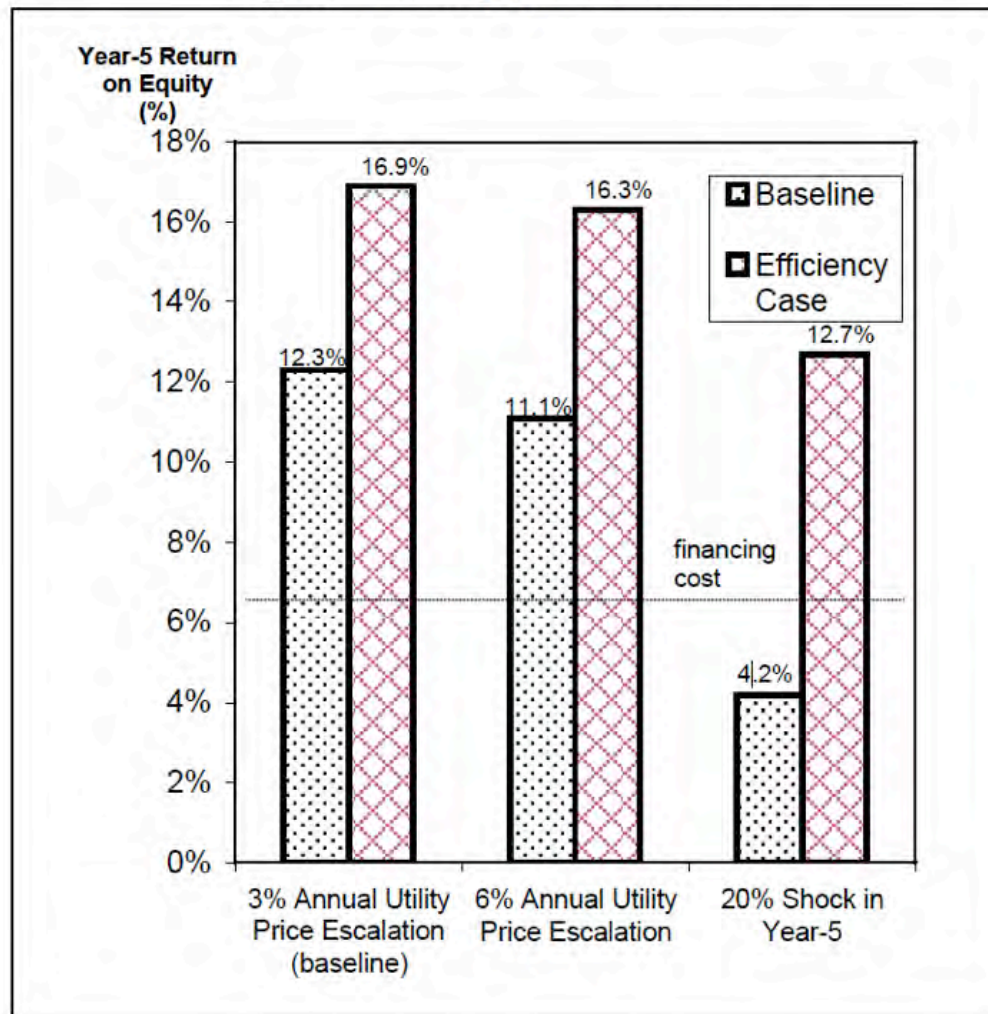
White Light-emitting Diodes (“LEDs”)



A century of electric lighting technology, with the “disruptive” entry of solid-state white lighting (“LED”) in the past decade.

Efficiency adds Value

- ~ Lower operating cost; higher yield
- ~ Hedge against energy price increases





CLIMATE SUMMIT

WHAT IF IT'S
A BIG HOAX AND
WE CREATE A BETTER
WORLD FOR NOTHING?

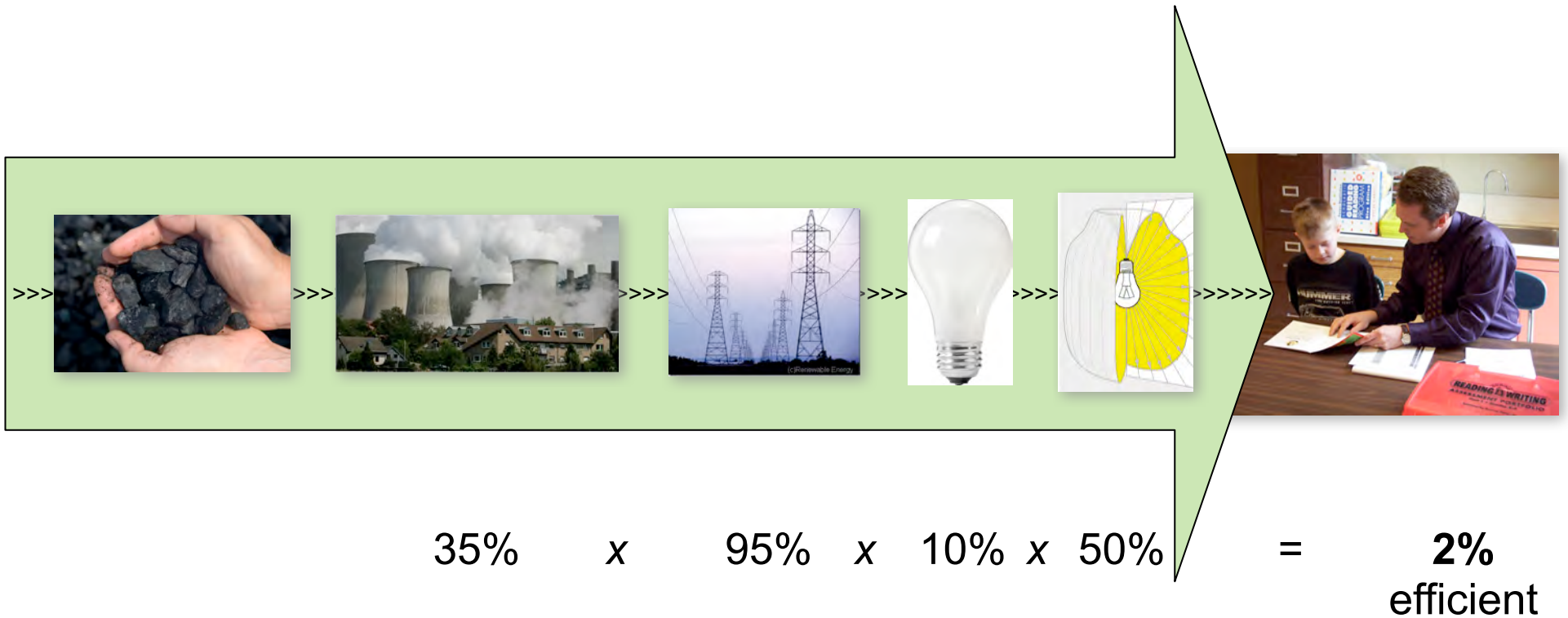
- ENERGY INDEPENDENCE
- PRESERVE RAINFORESTS
- SUSTAINABILITY
- GREEN JOBS
- LIVABLE CITIES
- RENEWABLES
- CLEAN WATER, AIR
- HEALTHY CHILDREN
- etc. etc.



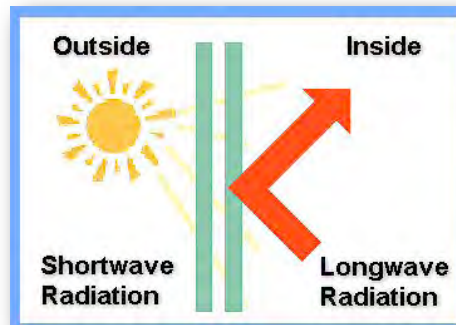
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DEL
Pitt

Energy Services



Potent Analogies



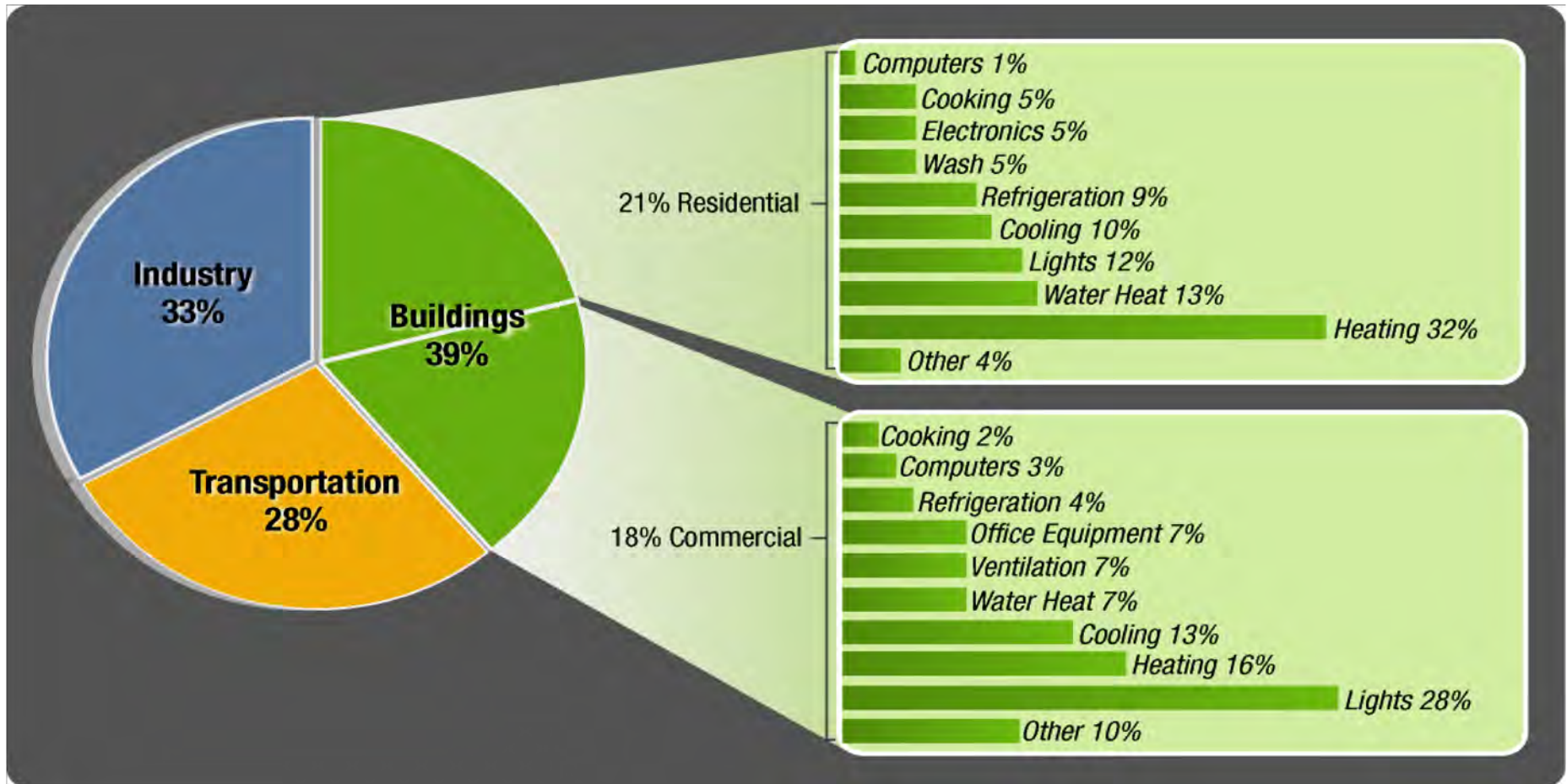
Offshore Oil Rig:
\$300 million

=

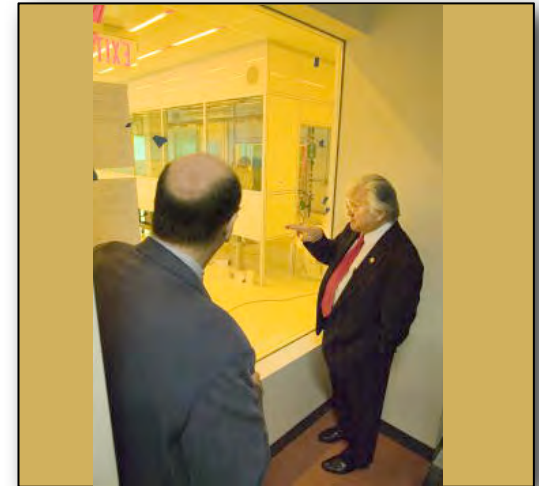


Low-E Window Coating Plant:
\$6 million

An “End-Use” Perspective



High Tech means High Efficiency





Thanks to downsizing of HVAC system, this building cost no more to build than a standard non-green version

LBNL's Molecular Foundry [Greenhouse Gas Emissions]

Pounds
CO₂/year

3,000,000

2,500,000

2,000,000

1,500,000

1,000,000

500,000

And this version was cheaper to build!

Kyoto Svgs

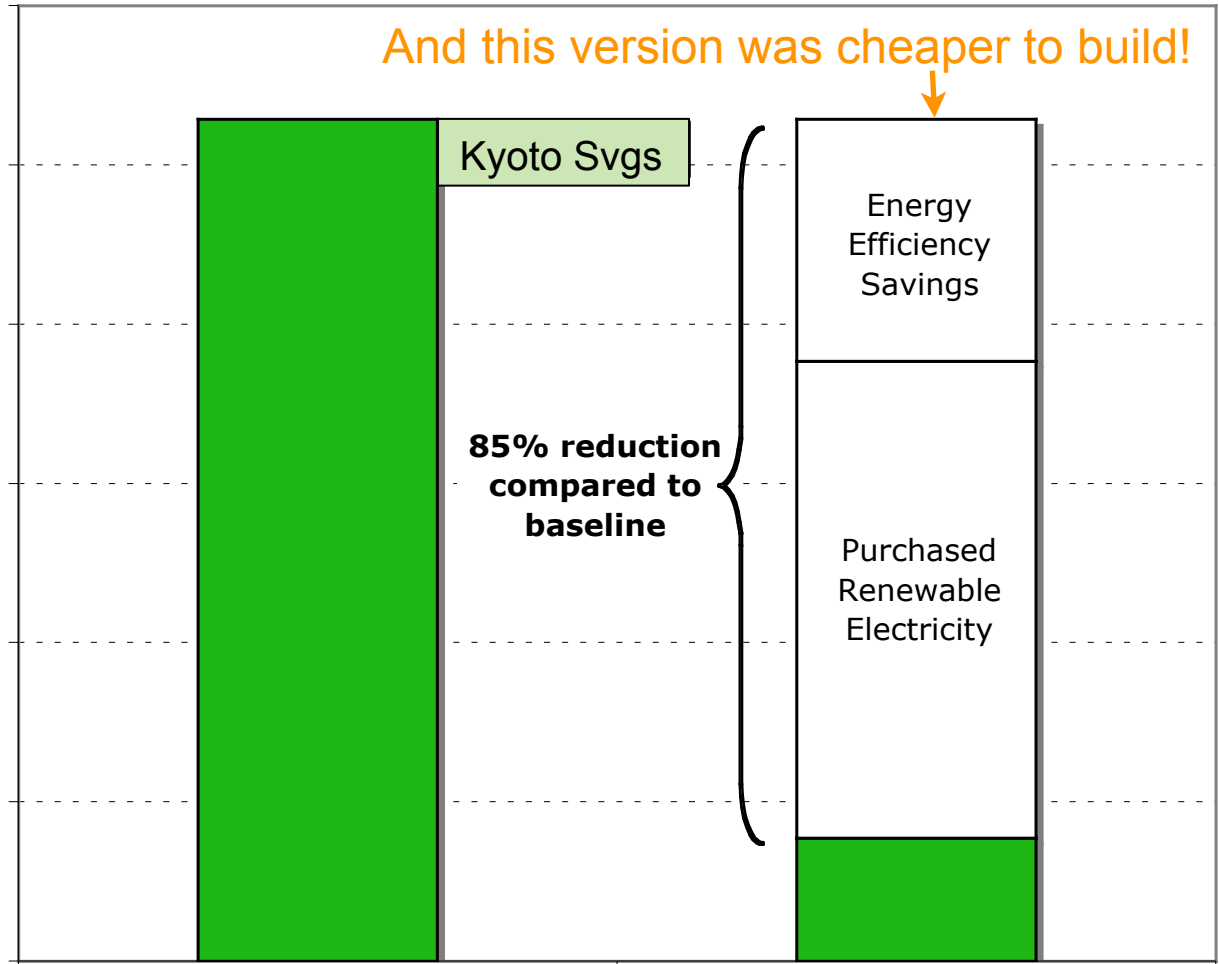
85% reduction
compared to
baseline

Energy
Efficiency
Savings

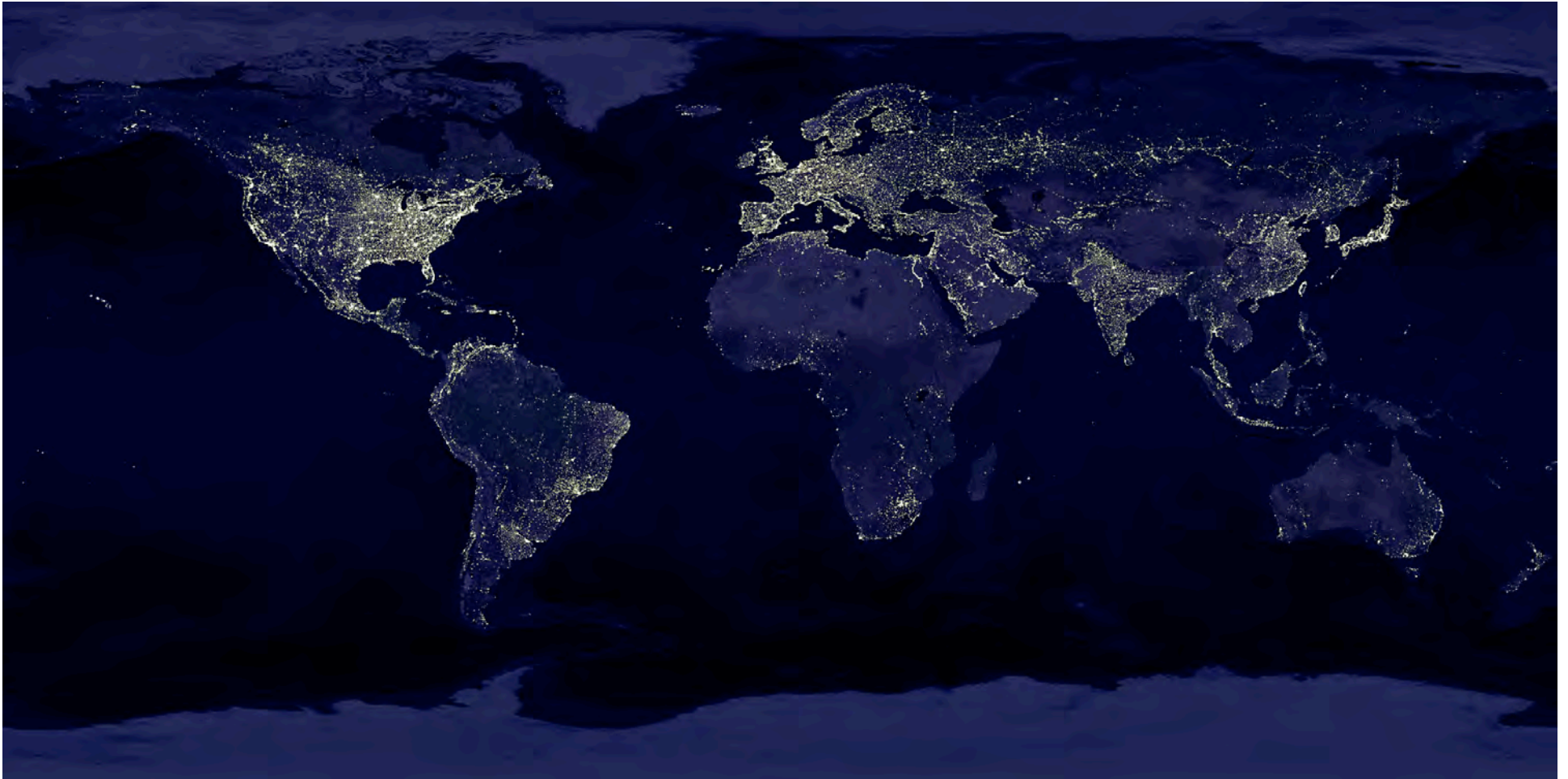
Purchased
Renewable
Electricity

Typical Construction

As-built



The Specter of Fuel-Based Lighting



**“We will make electricity so cheap
that only the rich will burn candles”**

- Thomas Edison



In the developing world, 14% of urban households and 49% of rural households have no electricity ... (2000 data)

... In fact, there are more non-electrified households today than the total number in Edison's time.

- \$40 billion/year spent by people earning \$1/day
- 1/10th of 1% of light provided
- 65 million cars worth of CO₂ emissions



Studying by streetlight



Guinea

Technology Leapfrogging

LED-based Solutions have a payback time < 1 year



Tanzania

Market Research



Kenya

Lighting and Literacy



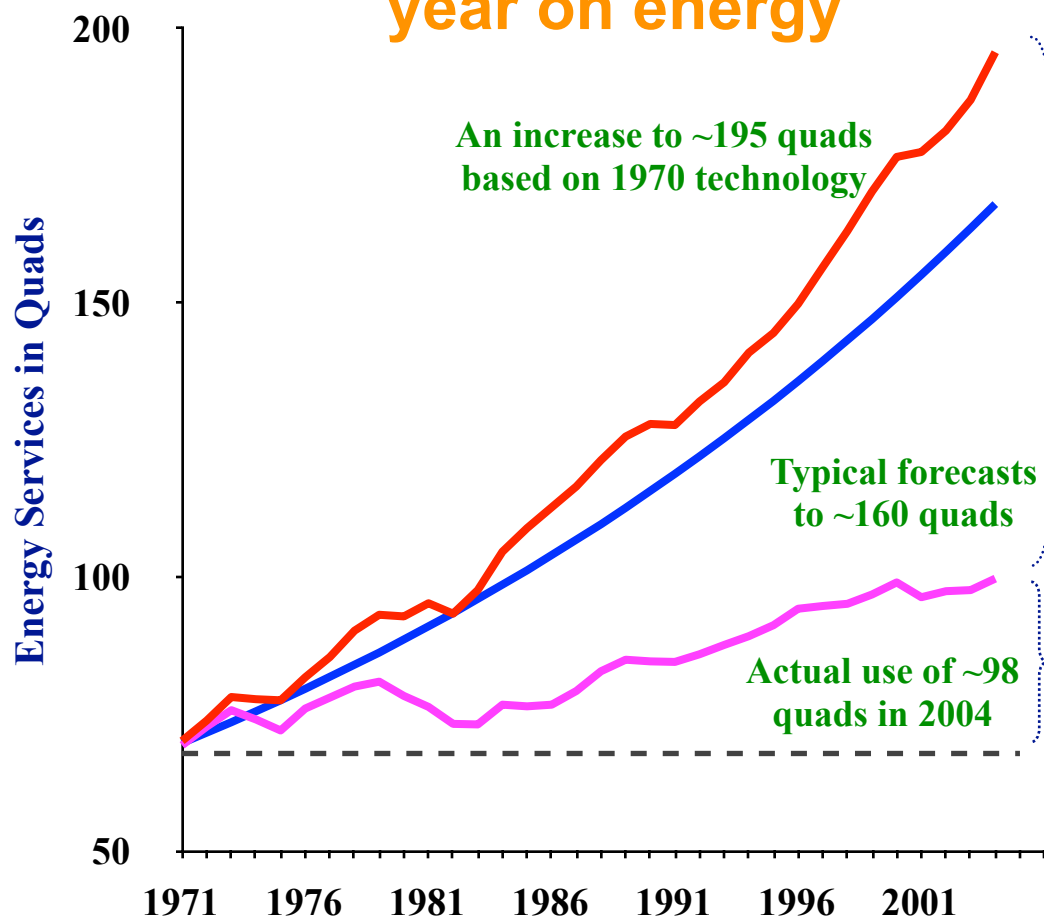
Kenya

World Bank Conference - Nairobi (2010)



Without New Efficiency Technology,* U.S. Energy Use Would Be 3x1970 Levels

**We spend > \$1 trillion/
year on energy**



Contrast 3 Energy Patterns

- ✓ Using 1970 Technology
- ✓ Standard 1970s Forecast
- ✓ Actual energy use since 1970

*Since 1970, energy efficiency
has met 75% of new energy
service demands in the U.S., ...*

- 8.9 times total domestic oil production
- 3.7 times total oil imports

*...while new energy supplies
have perhaps contributed only
25% of new energy service
demands.*

* Where “energy efficiency” is broadly defined as the difference between the 1970 and 2004 energy intensities.

Source: Skip Laitner, ACEEE

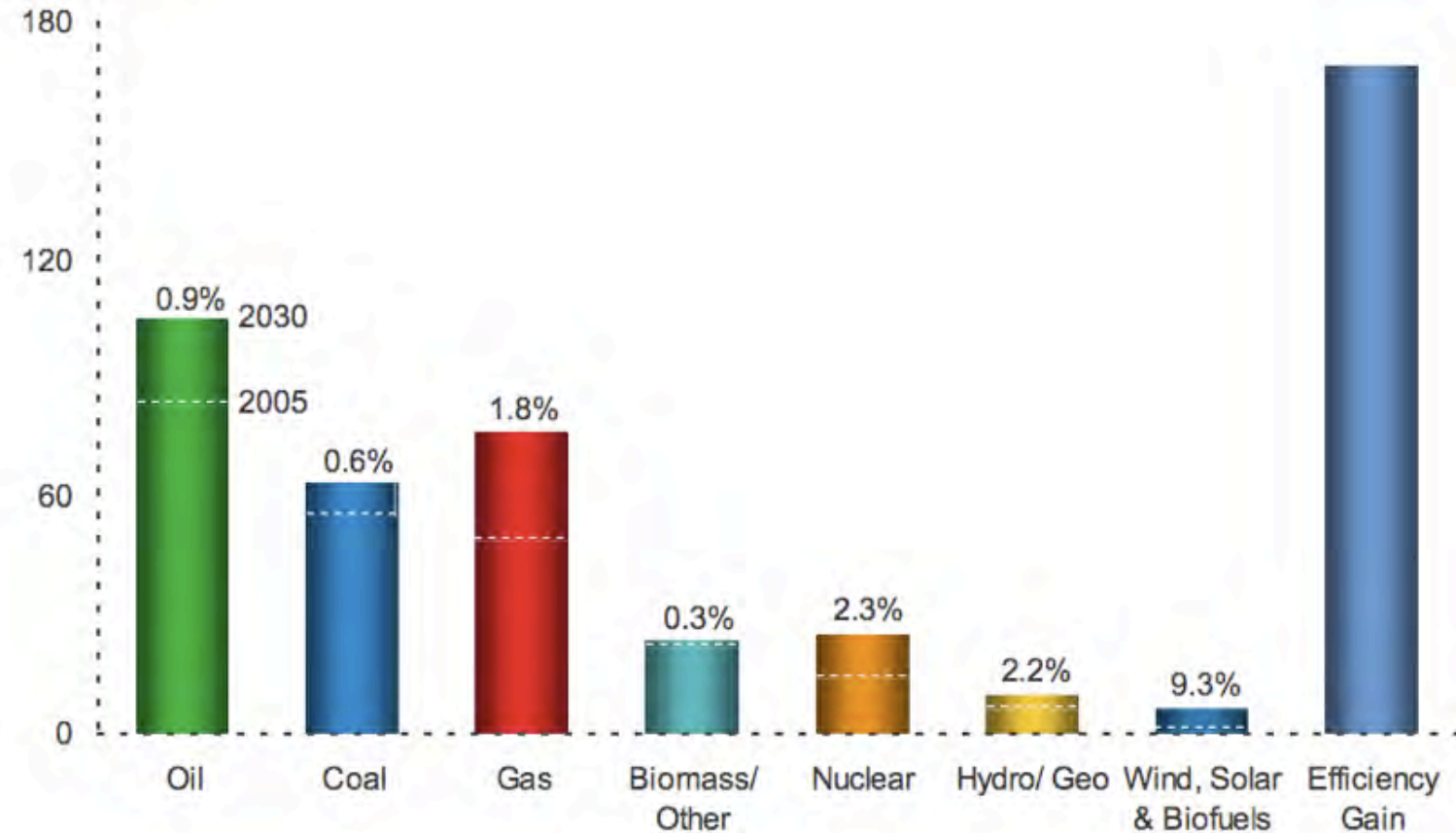
growing global energy demand



growing global energy demand

by fuel

MBDOE

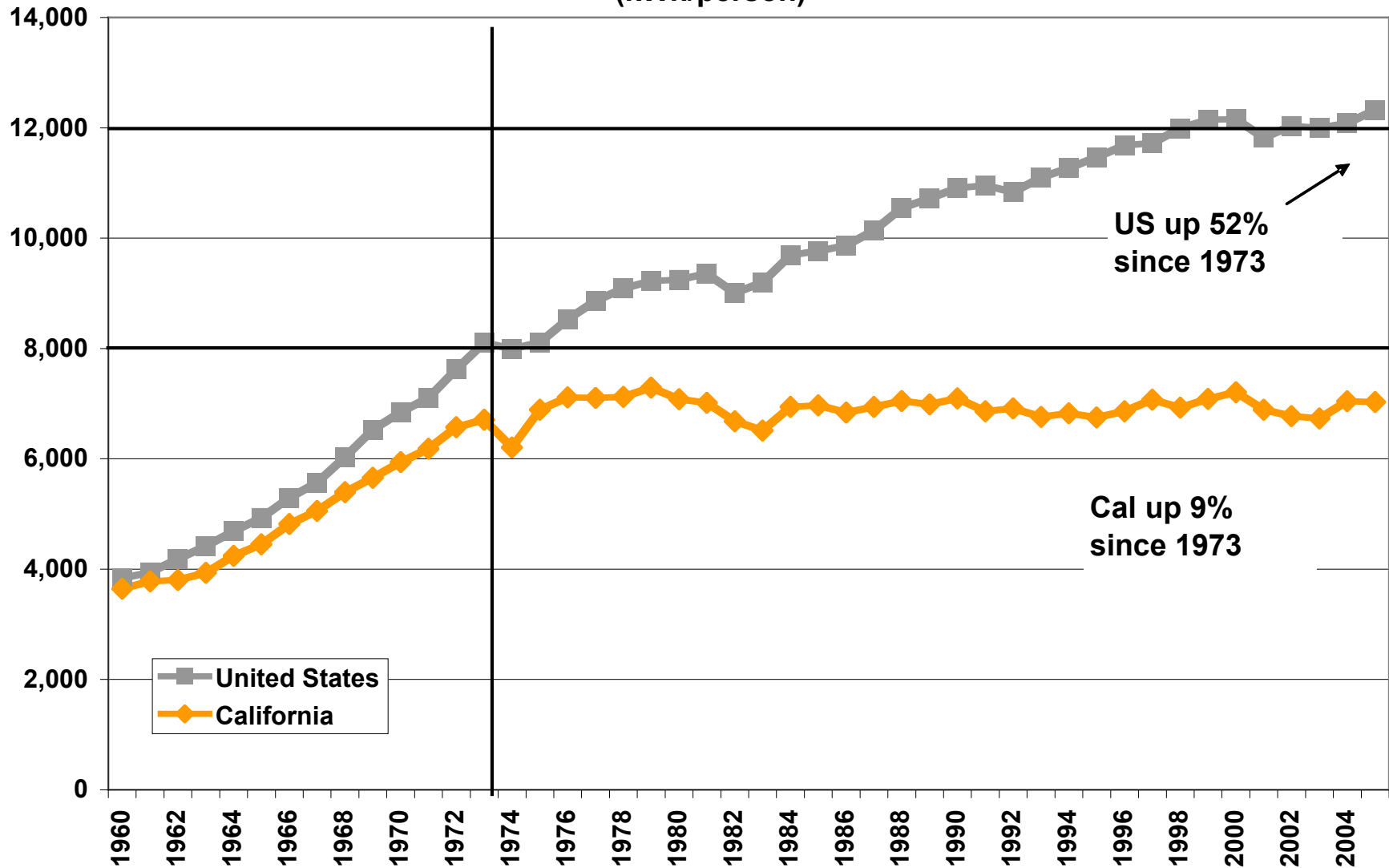


ExxonMobil

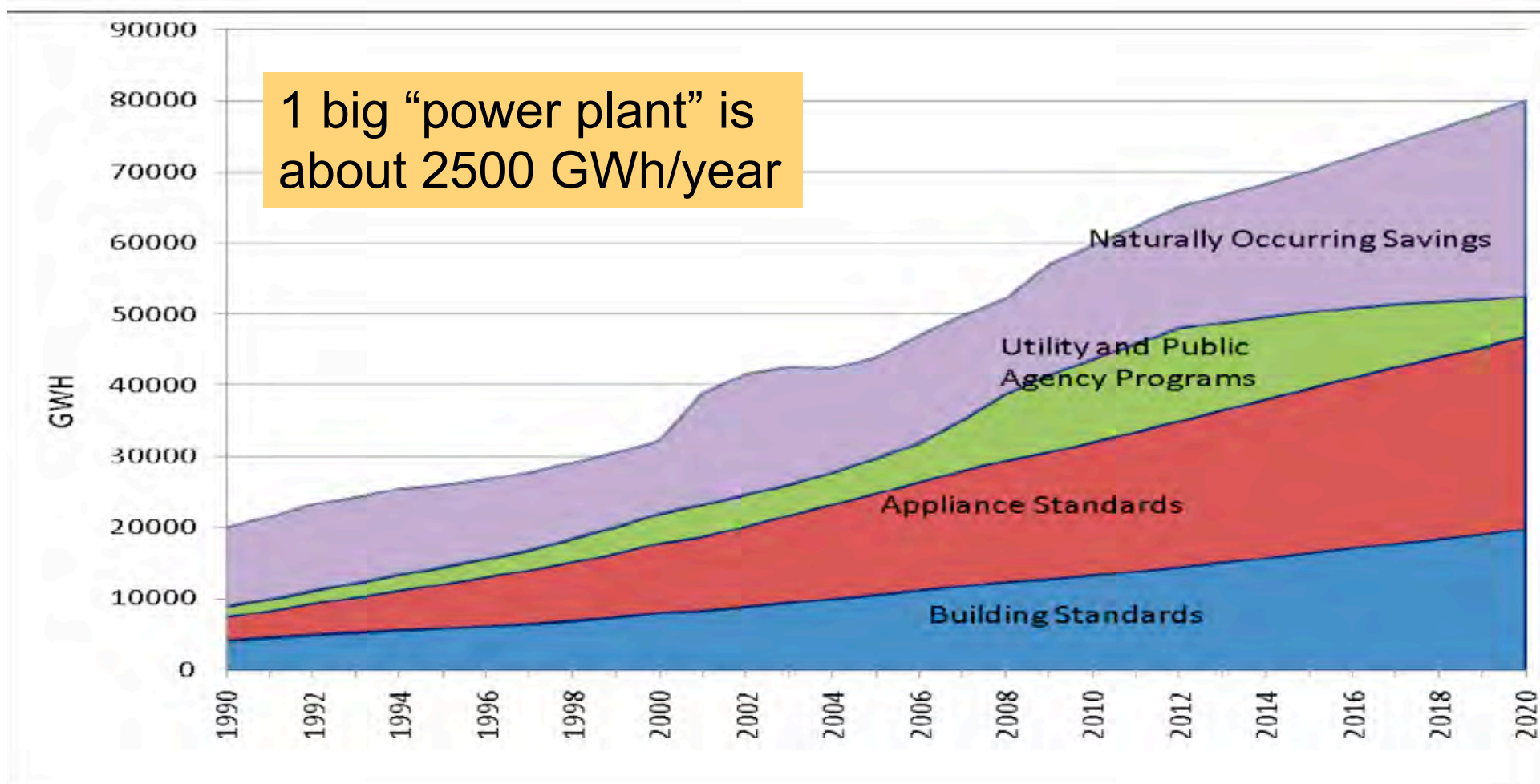
Taking on the world's toughest energy challenges.™

The California Story

Per Capita Electricity Sales (not including self-generation)
(kWh/person)

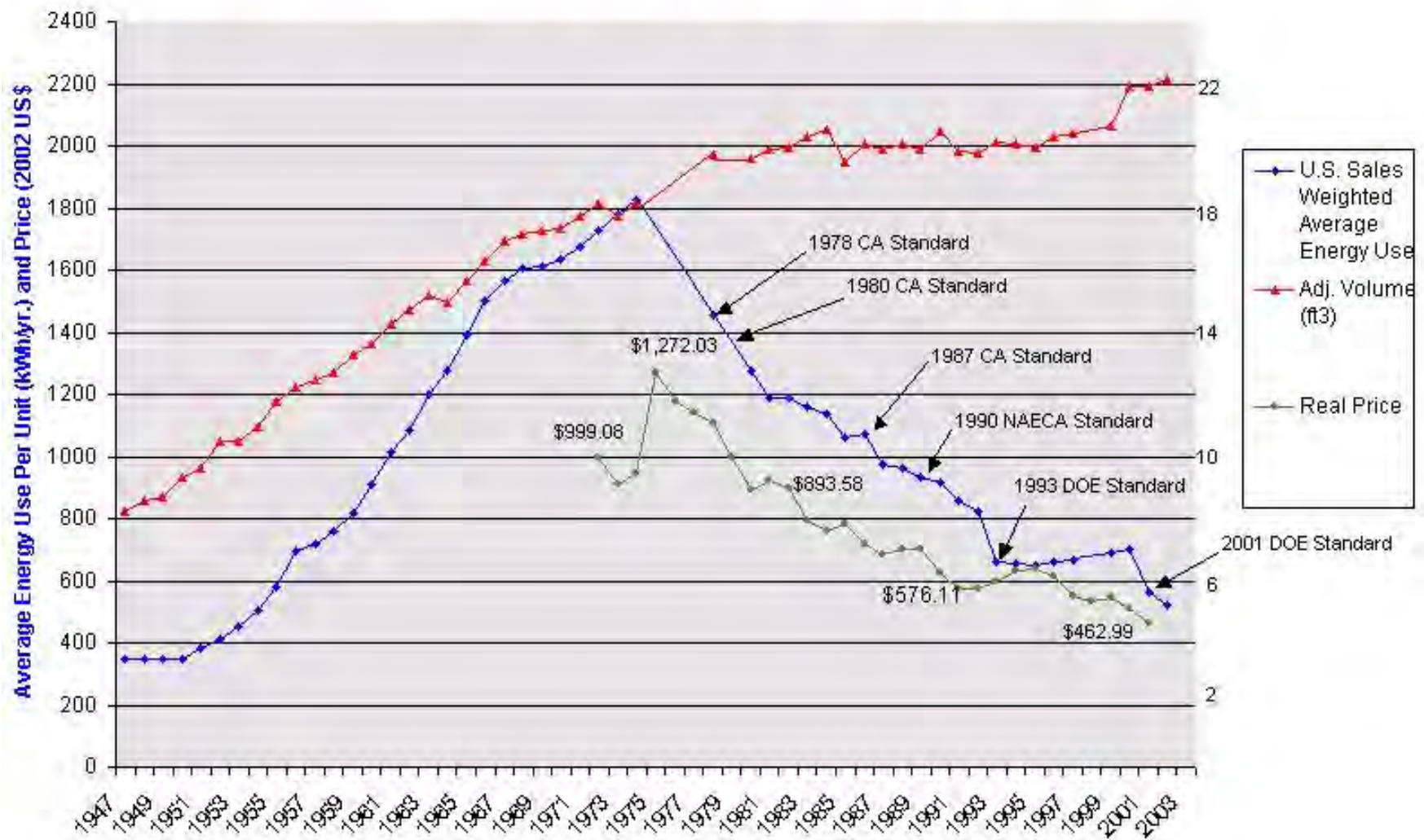


Savings from California Energy Efficiency Policies

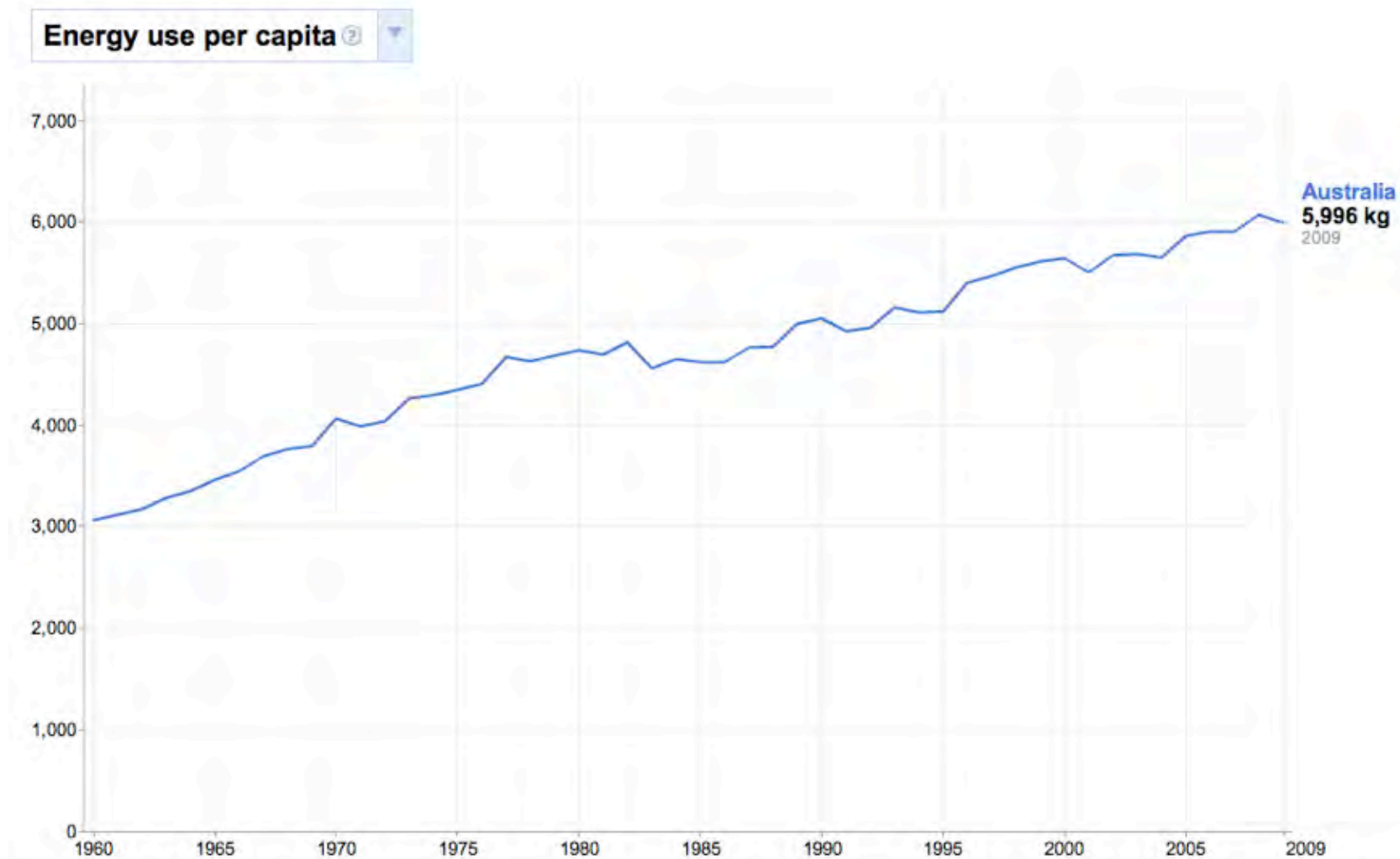


Source: California Energy Commission (2009)

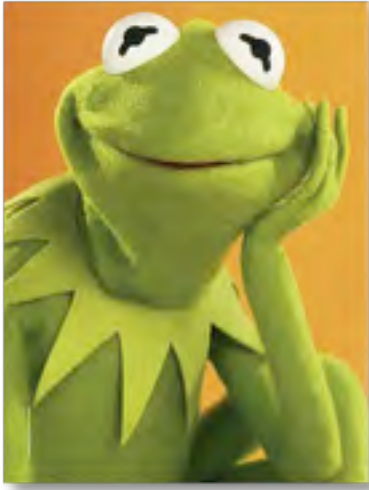
U.S. Refrigerator Energy Use v. Time with Real Price



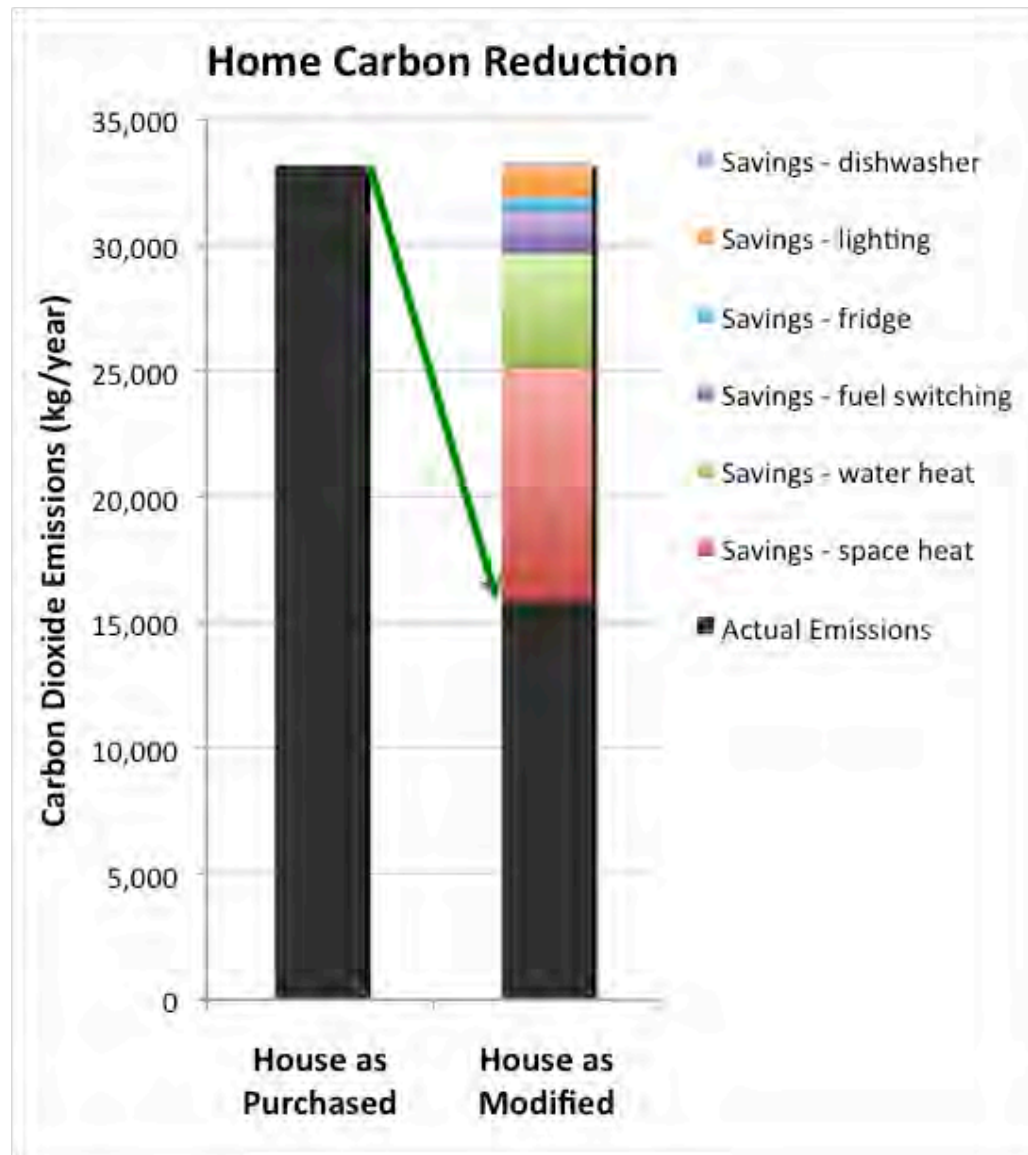
Australia

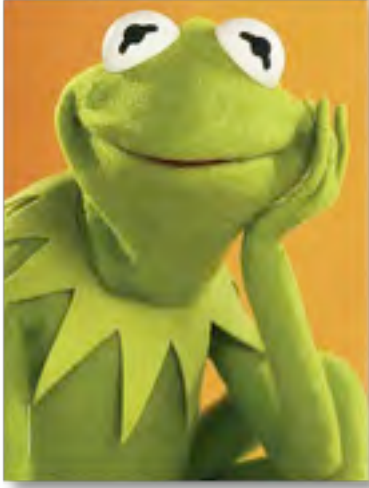


Source: World Bank



Kermit was Right





Kermit was Right



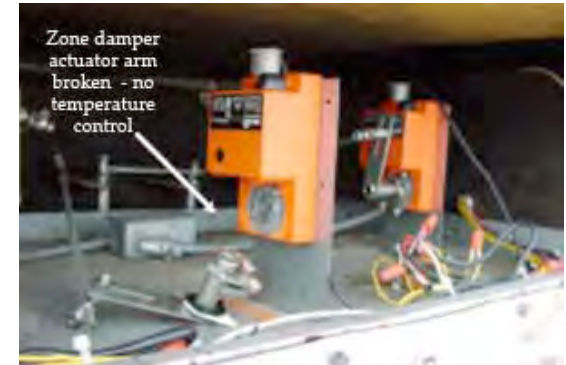
Hall of Shame



Hot water valve motion impeded by piping layout
[EMC no date (a)]



Exhaust fan hardwired in an “always on” position [Mittal and Hammond 2008]



Zone damper actuator arm broken (no temperature control)
[Martha Hewett, MNCEE]

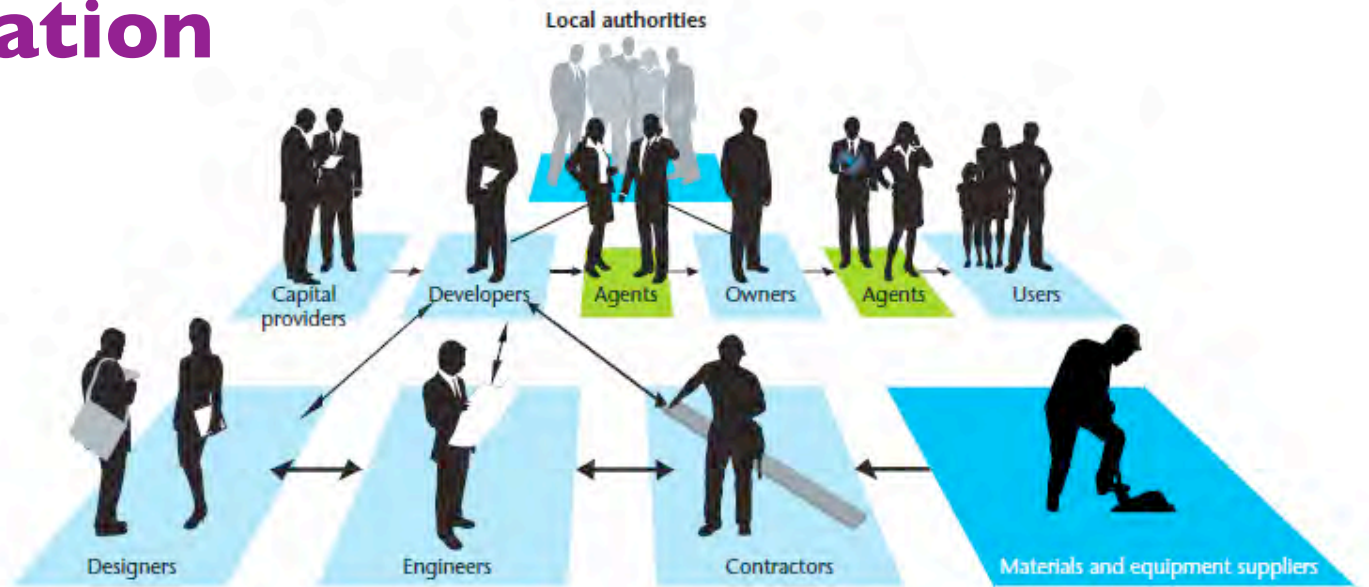


Rust indicates poor anti-condensation heating control setpoints in supermarket refrigeration cabinet [Sellers and Zazzara 2004]

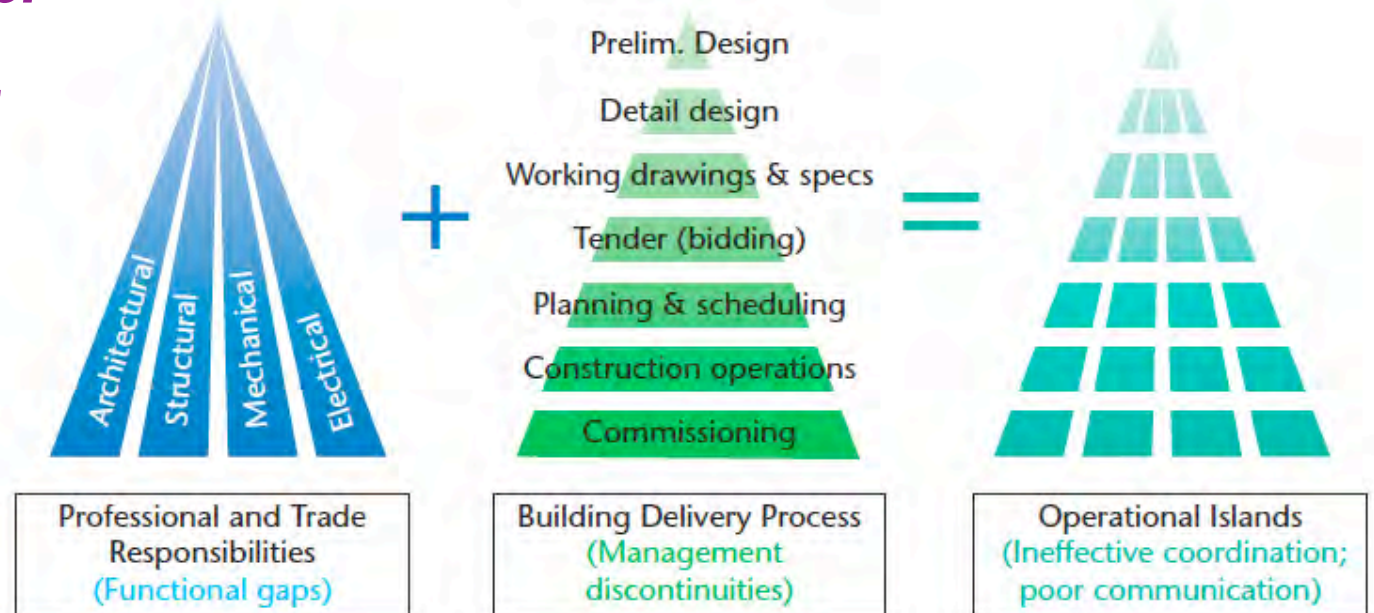


Inadequate fan cooling and excessive fan power due to poor fit between the light fixture and ducting, causing significant duct leakage [Martha Hewett, MNCEE]

- ~ **Fragmentation**
- ~ **Barriers**
- ~ **Frictions**



Burning need for coordinators & communicators



Bad design wastes energy and costs more



LBNL Database:

- ~650 buildings
- 99 million square feet
- \$43 million investment

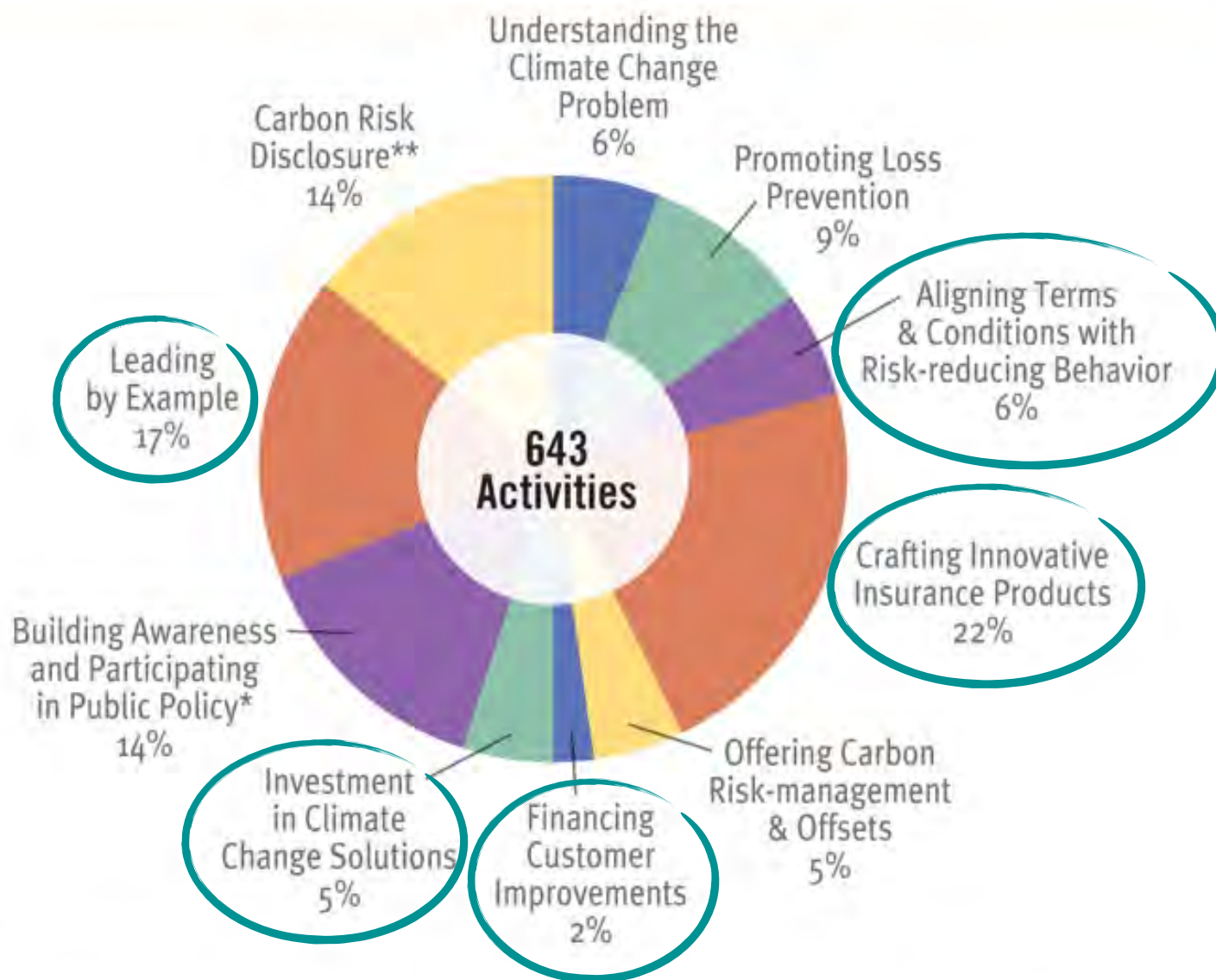
Deficiencies corrected: 10,000

Median energy savings: 16%

Median payback time: 1.1 years

AND ... insurance companies recognize commissioning as a way to mitigate property damages and liability claims

Insurance Initiatives



Sustainable = Disaster Resilient

Victoria's Bushfire Attack Level system

	BAL-LOW	BAL-12.5	BAL-19	BAL-29	BAL-40	BAL-FZ (FLAMEZONE)
SUBFLOOR SUPPORTS	No special construction requirements.	The special construction requirements.	No special construction requirements.	If enclosed by external wall or by steel, concrete or aluminium, non-combustible supports where the substrate is unexposed, suitably fix substrate spacers or posts at 75 mm vertical spacing.	If enclosed by external wall/below "External Wall" section it falls as non-combustible subfloor supports or tested for fire resistance to AS 1538.8.1	Subfloor supports – enclosure by external wall or non-combustible walls or fixed for fire resistance to AS 1538.8.2
FLOORS	No special construction requirements.	The special construction requirements.	No special construction requirements.	Concrete slab-on-ground, enclosures by internal wall, metal mesh or struts or floorings that rest upon slabs-on-ground; do not have combustion material directly beneath timber or protected on the underside with backing or retardant wood insulation.	Concrete slab-on-ground, enclosures by internal wall or protection of underside with a non-combustible material such as fibre cement sheet or be non-combustible or be tested for fire resistance to AS 1538.8.1	Concrete slab-on-ground or enclosures by internal wall or an FRL of R60/S30/D30 in protection of underside with 30 minute intumescent spreader of the system or be tested for fire resistance to AS 1538.8.2
EXTERNAL WALLS	No special construction requirements.	N/A for BAL-12.5	Internal walls – Fibres less than 400 mm above ground or studs are to be of non-combustible material & non-fire resistant cladding finishes must also comply fire-resistant timber.	Non-combustible material (masonry, brick veneer, masonry, solid brick, aerated concrete, concrete), stone framed, clad framed walls attached to the exterior and clad with 9 mm fibre cement sheathing or clad sheathing or be tested for fire resistance to AS 1538.8.1	Non-combustible structural framing, brick veneer, masonry, solid brick, aerated concrete, concrete) or timber framed or clad frame with solid core in the outside and clad with 9 mm fibre cement sheathing or clad sheathing or be tested for fire resistance to AS 1538.8.1	Non-combustible material (masonry, brick veneer, solid brick, aerated concrete, concrete) with minimum thickness of 90 mm or an FRL of /R60/S30 when tested from outside or be tested for fire resistance to AS 1538.8.2
EXTERNAL WINDOWS	No special construction requirements.	All BAL-12.5 except Class A and Class B safety glass can be used in place of 5 mm toughened glass.	Enclosed by fire-resistance rated, comprising glazing with steel, bronze or stainless steel or 5 mm toughened glass or glass blocks without dry air or gravel, back etc. Operable portion must connect with frame of metal or metal reinforced PVC-U or fire-rated meeting timber.	Perforation fire-resistance rating, comprising glazing with steel, bronze or stainless steel, or 5 mm toughened glass with operable portion connected with frame of metal or metal reinforced PVC-U, or fire-rated meeting timber and partition within 400 mm of ground level external.	Protected by fire-rated shutter or 5 mm toughened glass. Operable portion connects with stud or frame member.	Protected by fire-rated shutter or FRL of -/R30/- and operable portion connected with steel or bronze made to be tested for fire resistance to AS 1538.8.2
EXTERNAL DOORS	No special construction requirements.	All BAL-19 except lock down fitting can be externally fire-retarded (high density) timber.	Protected by fire-rated shutter, or screened with steel, bronze or aluminium mesh or glass with 5 mm toughened glass, anti-combustion or 25 mm steel frames for ALD non-down threshold, metal or fire-rated meeting timber frame for all non-alloy ground locking set, tight fitting with weather strips at least.	Protected by fire-rated shutter, or screened with steel, bronze or aluminium mesh or non-combustible, or 25 mm solid timber for 400 mm above finished floor. In fire-rated meeting timber framed tight fitting with weather strips at least.	Protected by fire-rated shutter, non-combustible or 25 mm solid timber, metal framed tight-fitting with weather strips at least.	Protected by fire-rated shutter or tight-fitting with weather strips at least and an FRL of -/R30/-
ROOFS	No special construction requirements.	ALL BAL-12.5	Non-combustible covering. Roofed portion sealed. Openings fitted with non-combustible ember guards. Roof to be fully sealed.	Non-combustible covering. External portion sealed. Openings fitted with non-combustible ember guards. Roof to be fully sealed.	Non-combustible covering. Roofed portion sealed. Openings fitted with non-combustible ember guards. Roof to be fully sealed and no roof mounted combustible markers.	Roof with FRL of R60/S30/D30 or tested for fire resistance to AS 1538.8.2. Roofed portion sealed. Openings fitted with non-combustible ember guards. No roof-mounted combustible markers.
VERANDAS DECKS ETC.	No special construction requirements.	ALL BAL-12.5	Finished sub-floor space – no special requirement for materials except within 400 mm of ground. No special requirements for supports or framing decking to become combustibles in fire-rated contact within 400 mm horizontally and below vertically facing ground element.	Finished sub-floor space is non-combustible or fire-rated contact timber supports. Decking to be non-combustible.	Finished sub-floor space is non-combustible supports. Decking to be non-combustible.	Finished sub-floor space or non-combustible supports. Decking to be non-combustible or non-combustible.

Highest level of window protection attained *most cost-effectively* by dual-pane, tempered glass

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<http://evanmills.lbl.gov> • emills@lbl.gov

QUESTIONS?

